

The "Spontaneous" Formation of Rudimentary Carpels on Leaf Tissue

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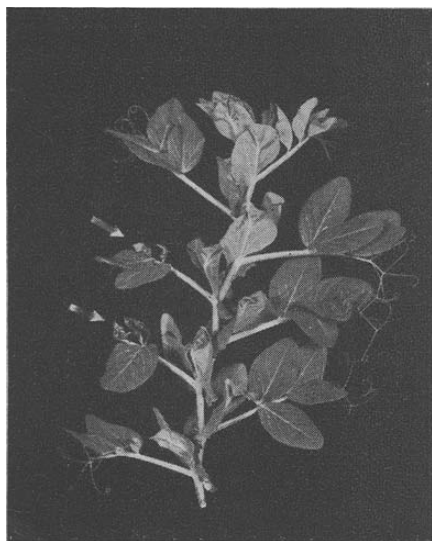


FIG. 1. Apical portion of a pea plant showing marked morphological modification of leaf tissue. Note especially the two leaves indicated by arrows.



FIG. 2. Enlargement of two leaves in Fig. 1. Rudimentary carpels are clearly visible. Leaflet in lower center of photo is partially folded upward and inward.

The angiosperm carpel is interpreted, according to the classical botanical theory, as a modified vegetative leaf. Specialization into a reproductive organ is believed to have occurred through the evolutionary process. Despite abundant supporting evidence, the classical theory is periodically challenged, its antagonists disclaiming any homology between foliar and floral organs (see discussion in Eames, A. J. 1961. *Morphology of the angiosperms*. McGraw-Hill. 518 pp.).

Dramatic evidence in support of the

classical interpretation has recently been secured quite by accident. In a greenhouse experiment designed to study the genetic nature of photoperiodism in peas, *Pisum sativum* L., a striking morphological modification was observed on a number of photoperiodic plants.² When plants of the requisite genotype are grown under a short photoperiod, they fail to flower but continue to develop vegetatively. A number of such plants remained vegetative for about 6 months and developed over 60 vegetative nodes. In contrast, these same plants, if exposed

¹ Approved by the Director of the New York State Agricultural Experiment Station for publication as Journal Paper No. 1398, May 28, 1964.

² The original observation was made by the junior author.



FIG. 3. Further enlargement reveals details of rudimentary carpels with stylar hairs and partial fusion of lamina (carpel at right).

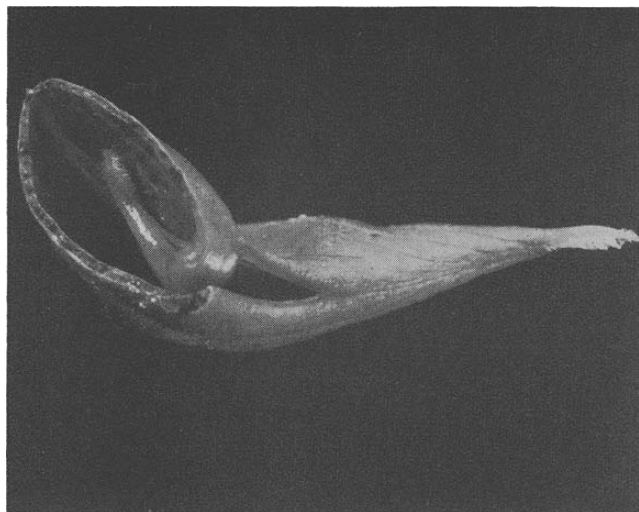


FIG. 4. Peripheral edges of laminar tissue have become fused to form adaxial suture.



FIG. 5. Closeup of stigma and style on rudimentary carpel.



FIG. 6. Anomalous development of a rudimentary carpel. Additional rudimentary carpels are borne at periphery where ovule primordia would be anticipated.



FIG. 7. Distal portion of a carpel of a normal fruit showing development and orientation of style and stigma.

to a long photoperiod, will flower in less than 2 months or after 18 to 20 nodes have developed. It was on the leaflets of plants which remained vegetative that rudimentary carpels were found.

Fig. 1 shows the apical portion of a branch on which a morphological modification is pronounced on two leaves. Progressively greater detail is seen in Figs. 2-6. That the rudimentary carpel is formed by a folding upward of the laminar tissue is evident from Figs. 2, 3, and 4. The ultimate fusion of the peripheral regions of the lamina to form the adaxial suture is also evident in Fig. 4. The structure and orientation of the style and stigma of the rudimentary carpel (Figs. 3, 4, and 5) closely resemble

the same structures on a normal fruit (Fig. 7).

Ovule primordia could not be observed macroscopically in the rudimentary carpel. Instead, additional styles and stigmas were developed where ovules would be expected (Figs. 4 and 6). Detailed morphological and anatomical studies will be undertaken elsewhere.⁸

The population was planted October 10, 1963 and was grown in the greenhouse without supplemental illumination. The natural photoperiod at Geneva, New York (latitude 42°53', longi-

tude 77°00', elevation 615 ft) from September 26 to March 17 is 12 hours or less. Definite experimental evidence is lacking, but the critical day length for the photoperiodic response in peas appears to be 12 hours. The greenhouse was equipped with automatic temperature controls which were set to provide approximate temperatures of 14 C from 5:00 p.m. to 8:00 a.m. and 22 C from 8:00 a.m. to 5:00 p.m.

Although under conditions provided during 1963-64, at least 7 plants were affected, it is uncertain whether the described morphological modifications can again be induced. A similar experiment was conducted in 1962-63, but the phenomenon was not observed.

⁸ Preserved material was given to Professor D. W. Bierhorst, Department of Botany, Cornell University, Ithaca, New York.